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THE

Description and Explanation

OF

Mathematical Instruments,

Alphabetically disposed as now made with
all their Improvements; wherein the
Nature and Meaning of every Instru-
ment is rendered Plain and Intelligible to
every capacity.

Illustrated with *Copper Cuts* curiously Engraven.

Tho. Tuttell *Mathematical Instrument-
maker to the KING'S most Excellent
Majesty, at the King's Arms and Globe
at Charing-Cross, and against the Royal
Exchange in Cornhill, and J. Moxon at
the Atlas in Warwick-Lane.*

L O N D O N,

Printed for J. Moxon at the *Atlas* in
Warwick-lane, and Tho. Tuttell at
the *Kings-Arms and Globe* at *Charing-
Cross*, 1701.

Description and Explanation

OF

Arithmetical Instruments

Alphabetically disposed as now made with
various improvements; wherein the
Use and Manner of every Instru-
ment is rendered Plain and Intelligible to
every capacity.

Illustrated with Copper Engravings

By Thomas Digges, Mathematicall Instrument
maker to the KING, and Excellent
Surveyor at the Kings Arms and Ordnance
at the Ordnance Office, and Surveyor of the Kings
Treasure in the Exchequer, London.
The Atlas in Warrington

Printed for J. Smith at the Atlas in
Warwick-lane, and Tho. Smith at
the Kings Arms and Ordnance Office in London.

TO THE READER

OUR Design here is not to shew the strict Definition or Derivation of the Name of every Instrument because most of them are already explain'd but to give you a brief account of the general Meaning and Signification of the Instrument it Self, with the advantage every Improvement.

Not that so small a Tract as this can contain their particular Uses, but perhaps may stir up some of greater abilities, and much more leisure to treat severally of the Uses of each Instrument which will find a thankful Reception to all Practitioners.

To the Reader.

We are here confined to a very narrow
Compass, nor would willingly keep you too
long in Discourse upon any Instrument, but
refer you (for your better Satisfaction)
to the Figure it self, and in many Instan-
ces where the Instruments are drawn at
large by the Authors, we refer you to their
particular Books.

VADE

A *Amacanthor Staff*, made of *Peartree* or *Box* with an Arch of 15° deg. to take Observations of the Sun, about the times of his Rising and Setting, *Fig. 61.* in Order to find the Amplitude, and consequently the Variation of the Compass.

Analemma, an *Orthographick* Projection of the *Sphere* upon the Plain of the Meridian, on Brass or Wood, with a moving Diameter or Index on the Center, divided by *Sines* (which may represent the *Horizon* of any place) upon which is fitted a Semidiameter piece that slides at right Angles divided by *Sines* also; very useful for solving most Propositions in the Doctrine of the Sphere.

Arithmetical Instruments, are many ways varied. One sort (invented by *Sir Charles Cotterel*, call'd visible Arithmetick) is made of many small thin pieces of *Ivory* or *Rox*, with figures so Composed, that it performs Multiplication and Division, by Addition and Subtraction, and the Extraction of the Square and Cube Roots, and most Questions in Arithmetick with great ease; having in the Lidd of the Box a Contrivance of Beads or Wires to serve instead of Pen, Ink, and Paper, and to demonstrate Addition, Subtraction, &c. See the Book published by the permission of the Inventor.

See *Sliding Rules*, and what the several Authors say of the Application of them to Instrumental

mental Arithmetick, See also *Papier's Bones*.

Astrolabe, a Circle made in Brass with an Index and sights, having one *Quadrant* divided into 90 deg. to take Altitudes. Fig. 1.

Astronomical Calendar, an Instrument curiously Engraven on Copper Plates, Printed on Royal Paper, pasted on a board; with a Brass Slider, which carries a hair, and shews by inspection the Suns Amplitude, Declination, Meridian Altitude, right Ascension, time of his rising and setting, &c. to greater nicety than the largest Globes now made.

Astronomical Quadrant, Sextant, &c. Instruments (generally very large) curiously fram'd, and the deg. exactly and minutely divided by the help of a Screw on the Edge of the Limb, fitted with Telescopes, on a strong Axis or Pedestai, with 2 Semicircles plac'd at right Angles on 2 endless Screws, which readily direct or guide the Instrument, to take Observations of the Sun, Moon and Stars. See the description in *D. Hooker's Works*. F. 2.

Azimuth Compass, made in a large Brass Box, with jambols and a broad limb having 90 degrees diagonally divided, with an Index and Thread to take the Suns Amplitude or Azimuth, in Order to find the difference between the Magnetical Meridian and the Suns Meridian, which shews the Variation of the Compass, Fig. 3.

B

Barometer, } An Instrument invented to
Baroscope, } Measure the Weight of the
 Air, now used, to shew whether Humidity or
 siccity doth most prevail in the Atmosphere: and
 from thence foretels (Mercury rising) Fair or
 Frost (Mercury falling) Rain, Snow or Wind.
 See the Learned *Boyle* and *Glanvil*. Now made
 so Portable, that 'tis applicable to take the Height
 of Mountains, Hills, Steeples, &c. and the depth
 of Caves, Wells, Mines, &c. Also much us'd
 to foretel Storms at Sea, Fig. 4.

Ball and Socket, made of Brass, with a per-
 petual Screw, to hold any *Telescope* or Instru-
 ment on a Staff for Surveying, Astronomy, &c.

Beam Compasses, an Instrument made in
 Wood, or Brass, with sliding Sockets to carry
 several shifting Points for large Projections, and
 much used for drawing the Furniture on Wall-
 Dials: by many Practical Artists, Fig. 5.

Bevel, an Instrument common to Builders,
 Carpenters, and Bricklayers, Fig. 6.

Bow, an Instrument made in Wood, former-
 ly used by Seamen, to take the Altitude of the
 Sun.

Bow, a Beam of Wood or Brass with 3 long
 Screws, that Govern or Direct a lath of Wood
 or Steel, to any Arch: used commonly to draw
 Draughts of Ships, Projections of the Sphere,

or wherever 'tis requisite to draw large Arches, Fig. 7.

Bricklayers Rules, generally made of Box, 2 Foot or 18 Inches Long, with a Joynt to fold, and Lines properly adapted to Measure Brick-Work, Fig. 8.

C

Carpenters Rules, made of Box, 2 Foot or 18 Inches long, to shut with a Joynt, with Timber and Board Measure, *Gunters* line Inches, and Foot Measure, Fig. 8.

Chains, made for surveying of good hard Wire, according to *Rathborn, Leiborne, Wing, &c.* see *Gunters* Chain also.

Charts, are Draughts projected for the use of Seamen, much Corrected by our Modern Artists, which discover the Shelves, Sands, Rocks, &c. Clearly explain'd by all Navigation Authors.

Circumferentor, an Index and sights of Wood, or Brass, Fig. 9. with Box and Needle, and Ball and Socket, fitted to a 3 Legg'd Staff, for surveying: also a Label, Fig. 29. with a Tangent Line, on the Edge of the Index, to take Altitudes, generally used to take the bearings, very fit to survey large Mannors, Counties and Lordships.

Callipers, made like a sliding Rule, to embrace the 2 heads of any Cask, to find the Length. Fig. 10. See *Gunters* Callipers. Fig. 26.

Compass

Compass, the 32 Winds or Points, drawn on a Chard with a Brass Cap, fitted in the middle to hang tenderly on a Point, and a piece of thin Iron or Steel, fitted under the Meridian, or *North*, and *South* Line, which being touched on the 2 Poles of a Loadstone, always Direct themselves to the Magnetical Meridian, viz. nearly *North* and *South*, the difference is called the Variation of the Compass, see *Azimuth Compass*. is fitted in Brass, or Wooden Boxes, in Jambols or Hoops of Brass, with a Weight at the bottom, so that in all motions of the Ship the Chard or Fly, hangs always Level. This Instrument has mightily improved Trade and Navigation: the Compass is also very useful in Surveying, Di-alling, and many other parts of the Mathematicks.

Compass Dial, fitted in Boxes for the Pocket, that shews the Hour by the Direction of the Needle.

Compasses of Proportion, to divide Lines and Circles into proportional Parts at one opening of the Compasses, Fig. 28. very much used in reducing, or, enlarging of Maps, or Draughts, improved by adding, removing, or shifting points.

Cone, made in Box, and cut into the several Sections, called *Parabola*, *Hyperbola*, *Ellipsis*, *Triangle* and *Circle*, Fig. 11. the knowledge whereof is useful in drawing the Furniture on Sundials, &c.

Cross-staff, made of Box or Pear tree, commonly called a Fore-staff, because of taking forward Observations; and may be made also a

Back-staff, by adding a forth Vein and sight used by Seamen, to find the Meridian Altitude of the Sun or Stars, in Order to find the Latitude, also used in Surveying to take Angles, Fig. 12.

Cube, a regular Solid (one of the 5 Platonick Bodies) contained under 6 Square Planes for Dials, Fig. 13. sometimes cut into proportional Parts, to Demonstrate the Nature of the Square and Cube Roots.

D

Dark Tent, a Box made almost like a Desk with Optick Glasses, to take the Prospect of any Building, Fortification, Land-skip, &c.

Declinatoryes, a Pear-tree Box with a Compass and Needle, to take the Declination of Walls for Dialling, &c.

Draught Compasses, with several removing Feet to draw fine Draughts of Charts, Maps, &c. Fig. 60.

Dividers, are like a pair of Compasses, generally made in Steel, only confined by the help of a Screw to be more steady in small Operations; Fig. 14. sometimes a pair of Brass Compasses, Fig. 15. (call'd Platts) are used by Seamen, on Charts and Maps, as Dividers.

Dodecahedron, A Solid Figure contained under twelve equal Pentagons (one of the 5 Platonick Bodies) Fig. 58. sometimes fitted on a Pedestal with Dials drawn on every Plain, that Direct

D

7

direct one another to shew the true Hour of the Day.

Drawing-Table, with a Frame to hold a sheet of Royal Paper, for draughts of Ships, Gardens, and Fortifications.

Drawing-Pen, made with a pair of steel chops, governed by a Screw to draw lines finer or grosser, Fig. 16. also made to draw 5 or 6 lines together for Musick Books.

Dials, variously made; but the most ornamental and useful are graduated on large plates of Brass fix'd on Pedestals, Fig. 17. for the Gardens of the Nobility and Gentry, to set, examine, and adjust their Clocks and Watches. These sort of Dials are sometimes small for a Post or a Window.

Dialling Globe, made of Brass or Wood with a plane fitted to the *Horizon*; an Index, particularly contrived to draw all Sorts of Dials, and to give a clear demonstration of that Art.

Dialling Sphere, made of Brass, with several Semicircles sliding over one another, on a moving *Horizon*, to Demonstrate the Nature of the Doctrine of Spherical Triangles, and gives the true *Idea* of the drawing Dials, on all manner of Planes.

E

Elliptical Dial, made in Brass or Silver, with a Joynt to fold together, and the Gnomons to fall flat-Commodiously contrived

to take little room in the Pocket, and is preferable to most other Sun-dials, because it finds the true Meridian Hour of the Day, Rising and Setting of the Sun, and many other Propositions of the Globe, depending wholly on it self, Fig. 18. See *Tuttles* use.

Elliptical Compasses, made in Brass, to draw at one Revolution of the Index any Ellipsis or Oval, Fig. 19

F

Fore and Back-staff, See *Cross-staff*, Fig. 14

G

Gauging Rod, commonly made with 3 Joynts, with a Semicircle to take Diameters: See also the several sliding Rules, and the Application of them by the several Authors, to the Art of Gauging, Fig. 20.

Glaſiers Rules, made of 2 Pieces of Box that slide by one another, with lines well contrived for their Work, Fig. 21.

Globes, Coelestial and Terrestrial, in brass Meridians (with a Quadrant of Altitudes,) commonly

monly fitted in Walnut tree Frames Fig. 22. 23. being an easy Introduction to Geography and Astronomy; sometimes on a Pedestal only: fitted also in Cases for the Pocket. See use of the Globe.

Gunter's Quadrant, made in Wood or Brass, Curiously contrived to find the Hour and Azimuth, and most Propositions of the Globe: also, the Height of Trees, Steeples, &c. See a small Tract of its use, Fig. 24.

Gunter's Chain, made of Hard Wire, being 4 Poles in 100 Links, with Brass distinctions at every 10 Links, of Excellent use in Surveying of Land to the easy and speedy finding the Contents in Acres.

Gunter's Scale, made commonly of Box a Foot Long, with Numbers (called *Gunters Line*) and Sines and Tangents, with Chords, Rhombs, Leagues, Longitude, and equal parts, Inches and Foot Measure, and a double Diagonal Scale, &c. Particularly useful in Navigation, and likewise in most parts of the Mathematicks, Fig. 25.

Rules,

To find

Gunner,

{ Quadrants,
Callipers Fig. 26.
Powder tryals,
Heights,

{ the Diameter
of the
Ball & Bore
of the Gun,

Mouth pieces Fig. 27, strength and
Weight of Powder, Weight of Shot, length of
Ladle, Elevation of the Piece and many other
requisites.

Half

H

Half and whole Compasses, made of Brass, with Steel Joynts, used to enlarge or diminish Draughts, or Maps, so that to whatever distance you open the long Points, the other gives you the just half, Fig 28.

Hemispheres, Prints of the Heavens, pasted on a Board. See a Book of their use.

Horse Measures, commonly a Rod of Box to slide out of a Cane with a Square at the end, and Divided into Hands and Inches, to measure the Height of Horses.

I

Icosahedron, A Solid Figure (one of the 5 Platonick Bodies) contained under Twenty equal and equilateral Triangles, Fig. 29. used commonly on a Pedestal, for variety of Dials on each plain, that Direct themselves to shew the true Hour.

Imperial Table, made of Brass, with Box and Needle, and Staff; useful to measure Land, and particularly described, with a large Copper cut,
by

by the Contriver Mr. *John Wing*, in his late
Book of Surveying.

L

L Level, A long thin brass Ruler with a small sight at one end, and a Center hole at t^other; commonly used with a Tangent Line, on the Edge of a Circumferentor, to take Altitudes, Fig. 30.

Leavel, made of Wood or Brass, with 2 sights and a Glass, almost fill'd with Spirit of Wine, with a Cover divided into several equal parts, whereby to adjust the bubble, with a Sprang to fit it to a 3 Leg'd Staff, and a long Screw to rectifie the Bubble by the help of a Plummer, that hangs on one of the sights, Fig. 31. Sometimes instead of the long Screw, and Sprang we fit a Rack, being 2 Semicircles at right Angles, with a Thread or Worm, upon 2 Endless Screws, which with a Key readily brings the Instrument to a true Leavel; and sometimes to help the sight we add *Telescopes*. Formerly this Instrument was made with a Hollow Tube, and 3 Cups to be fill'd with Water (from thence called a Water-Leavel) but is not found so useful as before mention'd: to this Instrument belongs two Station-Staffs (see Station-Staff) Fig. 50. used by In-
gineers, Surveyors, and other Artists to find the true Leavel, for Conveying Water to supply Towns, making Rivers Navigable, unwa-
tering

tering Fens, dreining Boggs, &c.

Leavel, made of Wood with an upright piece to hold Thread and Plummer, Fig. 32 used by Builders.

M

Magnet, or Load-stone Armed with 2 Iron sides, that embrace the *North* and *South* Poles, which so mightily increases the Vertue or Power, that 'tis much more useful for touching Compasses, Needles &c. Fig. 33.

Micrometer, an Instrument made of Brass, with a Movement and a plate or face divided like a Clock or Watch, with an Index or hand, which (being turned) moves two Sliding Plates of Brass with hairs, and counts on the Plate the revolves or Turns of the endless Screw. This Instrument is fitted to a large *Telescope*, and used in Astronomy to find the Diameters of Stars.

Mine-dial, a Box and Needle with a brass Ring, divided into 360 degrees, with several Dials Graduated thereon, generally thus made for the use of Miners.

N

Napier's Bones, are numbering Rods made of small slips of Box or Ivory in a small Box.

Box for the Pocket, which performs Multiplication by Addition, and Division by Subtraction. used to answer several Questions in Arithmetick. See the Book of its use.

Nocturnal, an Instrument made of Box or Ivory, Divided on both sides to take the Altitude or depression of the Pole Star, in respect to the Pole it self, in Order to find the Latitude and nearly the Hour of the Night, Fig. 34. see its Explanation in most Books of Navigation.

O

Octahedron, A regular Solid (one of the 5 Platonick Bodies) contain'd under Eight Triangles, Fig. 35. used on a Pedestal, to draw various sorts of Dials.

Oughtred's double Horizontal Dial, made of Brass, with a double Gnomon, one to shew the Hour, on the outward Circle, the other to shew the same Hour in the Stereographick Projection. (drawn on the Plate) This not only finds the Meridian and Hour, but shews the Suns place, rising and setting, Declination, Amplitude, Altitude, and Azimuth, Diurnal Arch and many other useful Propositions, and very well apply'd to the making of Dials. See Book of the use, or *Oughtred's Circles of Proportion*, Fig. 17.

Parallel Ruler, made in brass or Wood to draw Lines parallel to each other: of great use in Fortification, Architecture and many other parts of the Mathematicks. Fig. 36.

Parallelogram, made of 5 Rulers of brass or Wood, with Sockets to slide or set to any proportion; used to enlarge or diminish any Map or Draught: used in Fortification, Building and Surveying.

Parallelogram Protractor, A Semicircle of Brass with 4 rulers, in form of a Parallelogram; made to move to any Angle; one of which Rulers is an Index which shews on the Semicircle the Quantity of any inward or outward Angle.

Perrambulator, (or Walking Wheel) made of Wood or Iron, commonly half a Pole in Circumference, with a movement and a face divided, like a Clock with a long rod of Iron or Steel, that goes from the Center of the Wheel to the Work. There are two Hands which (as you drive the Wheel before you) count the Revolution, and from the Composition of the Movement, and by the divisions on the Face shew how many Yards, Poles, Furlongs and Miles you go. A very useful Instrument speedily to measure Roads, Rivers and all level Lands: sometimes we make them to answer according to all foreign Measures.

Plain Table, An Instrument commonly made of Walnut tree, with a box Frame large enough to strain a sheet of paper; one side divided in-

to 360 Degrees, the other side divided into 180 Degrees, with equal parts on each side (to draw Parallels) to the Table is fitted a Box and Needle with a brass Ring divided into 360 deg. and the Points of the Compass drawn on a Plate of brass at the bottom, with a brass Sprang to fit a three legg'd Staff Fig. 97. There is also a brass Index and sights, not only to cut the degrees on the Plain Table, but fitted to the Box and Needle, to serve with a Label as a Circumferentor. Thus fitted it performs as the Theodolite Semicircle Circumferentor. See *Holuel, Leyborne,* and *Wing's* Surveying.

Plain Scale, made of box, a foot long, with a double Diagonal Scale, Sines, Tangents, Secants, Chords, Rhombs, Leagues, Longitudes and Equal parts: used by Seamen to solve their questions in Plain Sailing and to save their *Gunter*.

Blow, made of box or Pear-tree; used by Seamen to take the height of the Sun or Stars, in order to find the Latitude: it admits of the Degrees to be very large, and is greatly esteemed by many Artists.

Protractor, A thin Semicircle of brass or Silver, containing 180 Degrees diagonally (which is accounted the best way) or otherwise subdivided, figured both ways by 10, 20 to 180, and back again by 190, 200 and so to 360, Fig. 38. Some Artists will have 180 degrees graduated on a Parallelogram or long square in the nature of Tangents, and use it to draw Parallel Lines from the opposite degrees and parts; sometimes (for young Students) we make a Protractor, a whole Circle containing 360 Actual Degrees. These Instruments are used by Surveyors, Engineers,

gineers and others, speedily to protract or lay down any Map or Draught upon Paper, or wherever it is needful to measure or make any Angle.

Protracting Pin, A taper piece of brass with a Point of Silver, to draw black Lines on Mathematical Paper, and a small Head to screw out and turn in, which holds a fine Needle to prick off any Degree and part from the Protractor, Fig. 39.

Prisme, made commonly of box, and cut into 3 Pyramids. Fig. 40.

Q

Quadrant, made of brass, with ball, and socket and staff to take Altitudes, and used in Surveying, but somewhat tedious and troublesome where the Angles are more then 90 degrees.

Quadrant's, (call'd frequently *Davis's* Quadrant and Sea Quadrant) made of Box Pear-tree, or Ivory, composed of two Arches; the lesser Arch containing 60 actual Degrees, and the large Arch 30, which make a Quadrant (or 90 Degrees) diagonally divided into ev'ry minute of a Degree, with 3 Veins or Sights: the great Arch conveniently plac'd for the advantage of sight, the lesser for the advantage of the shadow. This Instrument is used by Navigators to take the Meridian Altitude of the Sun, in order to find the Latitude Fig. 4. sometimes we make the

Q

the large Arch to contain but 25. degrees, and the lesser Arch but 65. degrees, for convenience of Carriage.

R

Reducing Scale, commonly understood a thin broad piece of Box with several different Scales of equal Parts, and Lines to turn Chains and Links into Acres and Roods, (by inspection) used by Surveyors, to reduce any Map or Draught. Sometimes 'tis called a Surveying Scale.

S

Sector, made of Silver, Brass, Ivory, or Wood of all Sizes, and framed with a curious joint (formerly called a French joint) much improved in the contrivance and performance, with a piece to turn out to make a true Square. Lines from the Center are Sines, Tangents, Secants equal Parts, Rhombs, Polligons, Metals, Solids, Superficies, Hours, Latitudes, &c. Generally useful in all the practical Parts of the Mathematicks, Fig. 42. and particularly contrived for Navigation, Surveying, Dialling, Astronomy, Projection of the Sphere, &c. by Gunter, Foster, Collins, and others; likewise for Fortification and Gunnery.

S

(by Sir *Jonas Moore*) see his description and use. This Instrument, for its Numerous uses and easie carriage, bears one of the greatest Characters among Mathematical Instruments, and also well applied to practical Mathematicks, by several Foreign Authors.

Sciotheritum Telescopicum, an Horizontal Dial with a Telescope, adapted for observing the Moment of time, by Day or Night, to regulate and adjust Pendulum Clocks, Watches, and other time Keepers. See *Molyneux*, of the use with a Copper Cut of the Instrument.

Stamozzi's Rule, A 2 Foot joint Rule, with Work properly adapted for the use of Builders; See his Book of Architecture.

Semicircle, made of Brass, with an Index and sights, Box and Needle, Ball and Socket, and Staff; containg 180 Degrees, being half the Theodolet (See Theodolet.)

Serle's Scale, in Wood or Brass, with Lines Ingeniously adapted to the Art of Dialling. See *Serle's* Book of Dialling.

Sinical Quadrant, made of Brass or Wood, which by the Sines drawn from each side intersecting one another with an Index, divided by Sines also, with 90. Degrees on the limb, and 2 sights on the Edge, to take the Altitude of the Sun. Sometimes (instead of Sines) we divide all into equal Parts. Used by Seamen to solve (by Inspection) any problem of plain Sailing, and Questions in Astronomy, Fig. 43.

Sliding Gunter, made of Box, with a middle piece that slides between 2 pieces, with Lines to answer Proportions by inspection; chiefly used by Mariners, Fig. 44. See *Gunter's* Scale.

Sliding

Sliding Rules, for gauging and measuring: ingeniously contrived and applied by *Fartridge*, *Cogshall*, *Everard*, *Hant*, and others, who have wrote particularly on each. See their several Books.

Sliding Rule, in a Cane; fittly applyed to the Art of gauging, by Mr. *Everard*.

Sphere, made of Silver or Brass Hoops, or Rings, representing the Principal Circles of the Sphere (called a material Sphere) Fig. 45. or according to the Systems of *Ptolomy*, Fig. 46. *Ticho Brahe*, Fig. 47. and *Copernicus*, Fig. 48. See a Book of the use of the Globes,

Square, made of Brass or Wood, having one side perpendicular, or at right Angles to the other: sometimes made with a joynt to fold (for the Pocket) and sometimes has a back to use on a drawing Board, or any thing that has the Edges very strait to guide the Square, Fig. 49.

Station-staff, made of 2 Rulers that slide to ten Foot, divided into Feet and Inches, with a moving Vein or sight, two of which are used with a Leavel, and on the edges we divide the Links of *Gunter's Chain*: used in Surveying for the more easie taking off Sets, Fig. 50.

T

Tee, a double Square in the form of a T, Fig. 51. See Square.

Ten foot Raws, See Station-staffs.

Tetrahedron, A Regular Solid (one of the 5 plat-

nick Bodies) contained under 4 Triangles, Fig. 52. fitted on a pedestal with Dials.

Theodolite, a whole Circle made of Brass, containing 360 degrees, diagonally or otherwise divided, with an Index and sights moving on the Center, and a box and Needle in the middle having a Brass Ring divided into 360 degrees, and the points of the Compass drawn on the bottom, with a Ball and Socket, fitted on a staff to take heights and Distances. This is approved as an Excellent Instrument for Surveying, some will have Telescopes instead of the sights, Fig. 53.

Thermometer, a Sprit glass fitted in a frame on a Scale which by rarefaction and condensation, shews all the unpercievable alterations of the Air, as to Heat and Cold, used in Greenhouses Bagnio's, &c. A great help to frame a true History of the Weather, See the Learned *Boyle, Glanvil, Dr. Goad* and others.

Triangular Quadrant, being a Sector (see Sector) with a loose piece to make it an Equilateral Triangle, and has the Kalendar graduated on it, with the Sun's place, Declination; and many other useful Lines, and has two Quadrants, or 180 degrees on the Edge, and used with a Telescope, or sights to take Observations of the Sun, Stars, by the help of a Cross piece that has a string to fit it to a Ball and Socket, and Staff, sometimes with an Index and sights: used for Surveying. Some Artists will have Veins fitted and use it in Navigation. It is an excellent Instrument, ingeniously contrived to be very portable, and of great use in the Art of Dialling, Fig. 42. See *Brown's Book* of the use.

Triangular Compasses, containing 3 Legs or Feet, to take off at once any Triangle: used on Maps, Globes, &c.

Three Leg'd Staff, made with Joynts to shut together, and take off in the middle for the better carriage: to support Instruments for Astronomy, Surveying, &c.

U

Universal Equinoctial Dial, made of 2 Rings of Brass or Silver, that open and fold together with a bridge or Axis, and a slider, with little Rings to hang or hold it by, divided on one side of the great Ring into 90 degrees, and 2 Quadrants, or 180 degrees on the other, and 24 Hours subdivided on the face and inside of the lesser Ring: the Axis has the Suns Declination and Kalendar, according to the Old and New stile; this Dial finds the Latitude and Hour of the day and most propositions on the Globe, Fig. 55. See *Tuttle's* use.

W

Waywiser, for the pocket; a movement, like a Watch to Number or count your steps or paces, in Order to find how far you walk in a day.

Waywiser, for Chariots, to shew how far your Coach

Coach goes in a day: of the same Nature as the Perambulator only fitted to the great Wheel.

Waterpoise, to try the strength of Liquors, Fig. 56. See Dr. Hook's Works.

Watch-glass, being 4 Hours; used at Sea, to know when to change their Watches (Fig. 57.) they also use half Watches, Hour glass, Minute and half Minute Glasses, to count the knots when they heave the Log in Order to find the Ship's way.

U

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